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EFFECT OF DIFFERENT FERTILIZER BRIQUETTES AND ORGANIC MANURES ON YIELD, NUTRIENTS UPTAKE AND CHEMICAL PROPERTIES OF SOIL IN CHILLI (*CAPSICUM ANNUUM* L.) IN LATERITIC SOILS OF KONKAN

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ABSTRACT

A field study was carried out on a lateritic soils of Konkan for year *(*2010-2011) to study the effect of different fertilizer briquettes and organic manures on yield, nutrient uptake and chemical properties of soil in chilli (*Capsicum annuum* L.) in lateritic soils of Konkan. It is observed that the application of Urea-Godavari briquettes (3 briquettes per plant) first at transplanting, second at 30 DAT and third at 60 DAT was found significantly superior over rest of all the treatments in respect of yield. Application of Urea-Godavari briquettes first at transplanting, second at 30 DAT and third at 60 DAT recorded higher total N and P uptake while application of Urea-Suphala briquettes first at transplanting, second at 30 DAT and third at 60 DAT recorded higher total K uptake. The available nutrient status (N, P and K) in soil after harvest was found to be improved due to application of all three types of briquettes as compared to RDF and RDF based on soil test.

KEYWORDS: Chilli, Fertilizer Briquettes, Yield, Available Nutrients and Uptake

INTRODUCTION

Scientific and efficient use of fertilizers is important for sustainable agriculture. Chilli requires heavy supply of plant nutrients especially N, P and K fertilizers for ensuring good plant growth and giving higher yield. The fertilizers are powerful crop management tools and can make effective contribution to crop production only when all other production factors are in reasonable balance and receive appropriate attention. Number of investigators has shown that there is a definite and nearly constant requirement of NPK for production of high yielding varieties of crop. The efficiency of added N is about 50 per cent or less for P is about 20 per cent or for K is about 60 per cent (Balligar and Bennett, 1986). The low use efficiency of N and P is because of various reasons such as volatilization, denitrification, surface runoff, leaching losses and ammonia fixation in soil for phosphorus. More or less similar situation exists in case of potassium. There it would be better if all the three major plant nutrients are used in the briquette form. FYM, Poultry Manure and Vermicompost act not only as source of nutrient but also influence availability of native nutrients. In the absences of fertilizers, crop depends entirely on the mineralization of organically bound nutrients. Organic manures increase yield of crop since they supply almost all the nutrient in balanced quantities and also prevent loss of nutrients. As they are enriched with N, P and K, they supply more plant nutrients. The information regarding the effect of deep placement of briquettes containing N, P and K i.e. Urea-DAP, Urea- Godavari and SSP-Suphala briquettes and organic manures on yield response, Available nutrient status and uptake of nutrients is not available. Keeping these points in view, a field experiment is decided to undertaken.

MATERIALS AND METHODS

A field experiment was conducted during *rabi* 2011 in randomized block design comprising of twelve treatments with three replicate. Treatment are T_1 (control), T_2 (RDF), T_3 (Urea-DAP briquettes first two at transplanting and second one at 30 DAT), T_4 (Urea-DAP briquettes First at transplanting, second at 30 DAT and third at 60 DAT), T_5 (Urea-Godavari briquettes first two at transplanting and second one at 30 DAT), T_6 (Urea-Godavari briquettes First at transplanting, second at 30 DAT and third at 60 DAT), T_7 (Urea-Suphala briquettes first two at transplanting and second one at 30 DAT), T_8 (Urea-Suphala briquettes First at transplanting, second at 30 DAT and third at 60 DAT), T_9 (RDF based on soil test), T_{10} (FYM N based), T_{11} (Vermicompost N based) and T_{12} (Poultry manure N based). Application of briquettes were takes place at 7 to 10 cm deep mannuly in respective treatments. In case of treatment T_2 and T_9 application of Nitrogen (150 kg ha^{-1}) in two split doses first dose 1/2 was applied at transplanting and second 1/2 dose at transplanting while Phosphorous and potassium (50 kg ha^{-1}) each were applied in single dose at the time of transplanting. Similarly treatments T_9, T_{10} and T_{11} receiving FYM, Vermicompost and Poultry manure was applied at the time of transplanting on Nitrogen basis only. Soil of experimental field was clay loam in texture, strongly acidic in reaction, show low electrical conductivity and available N and medium P_2O_5 and high K_2O.

The nutrient content in soil sample was determined by following the standard producers. Soil sample were analysis for available N, P_2O_5 and K_2O. The treatment wise soil samples were collected, air dried and sieved through 2 mm sieve. The soils sample were analyzed for its chemical properties by employing the methods, pH and EC (Jackson, 1973), organic carbon (Black, 1965), available nutrients viz. N, P_2O_5 and K_2O method given by (Subbiah and Asija 1956), (Brays and Kurtz 1945) and (Jackson, 1973). The data were subjected to statistical analysis following Panse and Sukhatme (2000).

RESULTS AND DISCUSSIONS

The finding of the present study as well as relevant discussion have been presented under following heads and in table 1, 2, 3 and 4.

Effect on Yield of Chilli (q ha^{-1})

A glance look of table 1 revealed that the application of different fertilizers briquettes and organic manures has significantly influenced the yield of green chilli and stover over control. The highest green pod (124.20 q ha^{-1}) and dry pod (12.95 q ha^{-1}) yield of chilli was recorded in the treatment T_6 receiving Urea-Godavari briquettes first at transplanting, second at 30 DAT and third at 60 DAT (124.2 q ha^{-1}), which was found significantly superior over rest of all the treatments, therefore signifying the role of Urea-Godavari briquettes in better nutrition of chilli crop. While, the stover yield of chilli was found to be a non-significant. From the results of green, dry pod and stover yield of chilli, it is inferred that the crop of chilli responded well to Urea-Godavari briquette. The interaction between lateritic soil and Urea-Godavari briquette was better than that of Urea-DAP and Urea-Suphala briquette. This might be due to better extraction of nutrients from the soil treated with Urea-Godavari briquette. The deep placement of these briquette resulted into lower losses of nutrient owing to low fixation, low leaching and less loss through runoff followed by the better retention and release of macro as well as micro nutrients. The briquette form of fertilizer recorded maximum yield of tomato than non-briquette form, reported by Kadam *et al.* (2005) and Talpade *et al.* (2011).

Effect on Uptake of Nutrients by Chill

The data pertaining to the uptake of nutrients by chilli pod, stover and total nutrient uptake by chilli crop as influenced by different treatments i.e. application of different fertilizers and organic manures on chilli are presented in Table 1.

It was observed from the data that the uptake of nitrogen in the stover was increased from 6.70 to 18.13 kg ha^{-1} due to effect of various treatments but it was found statistically non-significant. The significantly higher uptake of nitrogen by the pod (18.83 kg ha^{-1}) and total uptake (36.96 kg ha^{-1}) in chilli crop were recorded with treatment T_6 and which was significantly superior over control. Significant increase in total nitrogen uptake by Chilli with application of recommended dose of fertilizer, application of organic manures as well as briquettes over control may be due to continuous availability of nitrogen as well as increase in the yield by application of different treatments (Kasture, 2001). From the perusal of the data on the maximum P uptake in stover (2.08 kg ha^{-1}), pod (2.88 kg ha^{-1}) and total uptake (4.60 kg ha^{-1}) in chilli crop were recorded in the treatment T_3, T_6 and T_8, respectively and which was significantly superior over control. The increased uptake of P might be ascribe to more availability of nutrients from added fertilizers and to the solubility action of organic acids produced during the degradation of organic materials. Bagal (2009) showed increase in phosphorus uptake due to deep placement of briquettes containing NPK in different levels. Whereas the significantly highest uptake of K by stover (36.38 kg ha^{-1}) was recorded to the tune of in the treatment T_7 and which was found at par with T_6, T_8, T_5, T_9 and T_2. Application of Urea-Godavari and Urea-Suphala briquettes first briquette at transplanting, second at 30 DAT and third at 60 DAT (T_6) significantly increased K uptake in pod (19.01 kg ha^{-1}) and total uptake (50.12 kg ha^{-1}) in chill. The briquette form of fertilizers recorded significantly higher K uptake by fruits of tomato than non-briquette form which was opined by Kadam (2002)

Effect on Chemical Properties of Soil

The maximum pH (5.68, 5.98, 5.92 and 5.68) at all stages was recorded by T_{12} treatment i.e. application of poultry manure (Table 2). It might be due to the Ca present in the poultry manure as well as other complex materials including high amount of organic matter which helps to increase the pH of soil. Das et al. (1991) recorded that decreasing trend of soil pH towards neutrality with increase in doses of poultry manure on an acid Alfisols. There was no significant change in E.C. values due to the application of RDF, FYM, vermicompost, poultry manure and different types of briquettes through the trial. The organic carbon content was decreased with application of inorganic fertilizers. The significantly highest values of organic carbon were observed in T_{12} (17.67 g kg^{-1}), (19.63 g kg^{-1}), (18.47 g kg^{-1}) and (19.97 g kg^{-1}) at 30, 60, 90 and after harvest stage, respectively. Singh *et al.* (2006) concluded that application of chemical fertilizers decreased the organic carbon content due to deterioration of soil structure.

Effect on Available N, P_2O_5 and K_2O

The perusal of data revealed that allS the treatments showed significant increase in available N and P_2O_5 status of soil over absolute control at all the stages of crop growth (table 3). The significantly highest available N (319.87, 331.29, 311.61 and 290.6 kg ha^{-1}) and P_2O_5 (18.64, 15.72, 15.54 and 13.71 kg ha^{-1}) were observed in the treatment (T_3). An increase in available phosphorus with the application of briquettes to rice crop was reported by Pillai (2004) and Bulbule *et al.* (2008). Seshadri Reddy (2005) reported the positive role of application of organic manure and NPK in increasing available phosphorus content of soil. It is observed from the data that the available K_2O content at 30, 60, 90 DAT and at

harvest ranged from 217.26 to 448.43 kg ha^{-1}, 248.69 to 469.20 kg ha-1, 241.46 to 447.40 kg ha^{-1} and 203.45 to 407.22 kg ha^{-1} respectively (Table 3). The available potassium content observed in soil was significantly higher in treatment T_7 which were significantly superior over rest of all treatments at all stages. At harvest, of chilli available potassium content of soil decreased as compared to the 60 and 90 DAT stages. This might be due to the utilization of potassium by chilli plant. Agate (1997) also observed depletion of potash in lateritic soil even after application of potassic fertilizers.

CONCLUSIONS

The results showed that application of UB-Godavari, UB-DAP and UB-Suphala forms of briquettes are promising source of NPK fertilizers as compared to straight fertilizers and organic manures for enhancing green chilli pod yield as well as nutrient uptake and soil properties of lateritic soil. Amongst the three types of briquettes, Urea-Godavari was found to be superior for increasing green chilli yield applied @ 3 briquettes per plant at an interval of 30 day for three times i.e. first briquettes at transplanting, second at 30 days after transplanting and third at 60 days after transplanting. While, higher uptake and available nutrient status of soil in respect to N, P and K found to be improved due to incorporation of briquettes.

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APPENDICES

Table 1: Effect of Different Fertilizers, Fertilizers Briquettes and Organic Manures on Yield and Total Uptake of N, P and K

Treatment No.	Yield (q ha^{-1})			Nitrogen (kg ha^{-1})			Phosphorus (kg ha^{-1})			Potassium (kg ha^{-1})		
	Green Pod	Dry Pod	Stover	Stover	Pod	Total	Stover	Pod	Total	Stover	Pod	Total
T_1	82.83	8.60	7.04	6.70	10.09	16.79	0.67	1.89	2.56	9.65	11.07	20.72
T_2	97.47	9.24	10.05	16.74	11.90	28.64	1.10	2.49	3.60	25.04	11.58	36.63
T_3	91.90	8.77	9.12	11.43	13.15	24.58	2.08	2.19	4.27	21.20	10.99	32.19
T_4	85.63	8.80	9.31	11.52	11.36	22.88	1.48	2.14	3.62	19.99	11.37	31.36
T_5	103.73	9.72	11.06	16.69	14.84	31.53	1.84	2.37	4.21	29.68	12.34	42.02
T_6	124.20	12.95	12.85	18.13	18.83	36.96	1.65	2.88	4.53	31.11	19.01	50.12
T_7	105.93	10.19	11.30	16.41	15.94	32.35	1.98	2.46	4.44	36.38	12.93	49.31
T_8	109.33	11.16	12.27	15.58	16.41	31.99	2.04	2.56	4.60	30.75	16.46	47.21
T_9	98.63	9.30	10.47	17.17	12.82	30.00	1.31	2.51	3.82	26.67	12.11	38.78
T_{10}	105.53	10.04	11.20	11.64	13.31	24.95	1.06	2.41	3.47	22.47	14.29	36.76
T_{11}	107.07	10.88	11.53	11.70	14.26	25.96	1.05	2.63	3.69	19.46	14.65	34.12
T_{12}	98.37	9.30	10.74	11.85	12.98	24.83	1.33	2.54	3.87	22.82	12.98	35.80
S.E. ±	**1.97**	**0.23**	**1.77**	**2.08**	**0.49**	**2.30**	**0.22**	**0.12**	**0.28**	**4.58**	**0.60**	**4.63**
C.D (P=0.05)	**5.78**	**0.67**	**N.S.**	**N. S.**	**1.43**	**6.74**	**0.66**	**0.35**	**0.83**	**13.44**	**1.77**	**13.57**

Table 2: Effect of Different Fertilizer Briquettes and Organic Manures on Ph, Electrical Conductivity and Organic Carbon of Soil

Treatment No.	Soil pH (1:2.5)				EC of Soil (1:2.5)				Organic Carbon (g kg^{-1})			
	30 DAT	60 DAT	90 DAT	AH	30 DAT	60 DAT	90 DAT	AH	30 DAT	60 DAT	90 DAT	AH
T_1	5.43	5.44	5.53	5.38	0.11	0.11	0.11	0.11	14.20	16.67	13.90	15.47
T_2	5.63	5.76	5.64	5.26	0.26	0.22	0.11	0.41	15.20	17.90	13.77	15.20
T_3	5.61	5.63	5.67	5.45	0.19	0.16	0.11	0.17	15.73	18.43	15.47	16.27
T_4	5.62	5.69	5.61	5.40	0.21	0.15	0.19	0.19	15.60	16.68	15.47	17.67
T_5	5.63	5.66	5.61	5.47	0.22	0.20	0.14	0.16	15.07	18.17	14.80	18.70
T_6	5.45	5.53	5.70	5.39	0.16	0.21	0.11	0.18	14.80	16.93	14.80	19.37
T_7	5.54	5.61	5.54	5.39	0.14	0.18	0.16	0.22	14.57	16.68	15.10	17.87
T_8	5.47	5.62	5.67	5.46	0.21	0.18	0.18	0.21	14.67	18.03	16.13	18.20
T_9	5.46	5.61	5.60	5.51	0.18	0.17	0.13	0.15	15.07	17.33	16.13	16.63
T_{10}	5.67	5.87	5.71	5.64	0.16	0.16	0.13	0.12	17.30	18.83	18.10	19.37
T_{11}	5.66	5.86	5.69	5.63	0.18	0.15	0.11	0.15	16.67	18.43	17.07	18.83
T_{12}	5.68	5.98	5.92	5.68	0.16	0.15	0.12	0.16	17.67	19.63	18.47	19.97
S.E. ±	**0.05**	**0.04**	**0.05**	**0.04**	**0.03**	**0.03**	**0.02**	**0.06**	**0.38**	**0.27**	**0.59**	**0.65**
C.D. (P=0.05)	**0.15**	**0.13**	**0.15**	**0.11**	**NS**	**NS**	**NS**	**NS**	**1.11**	**0.78**	**1.74**	**1.91**

Table 3: Effect of Different Fertilizer Briquettes and Organic Manures on Available Nitrogen, Phosphorous and Potassium in Soil

Treatment No.	Available N (kg ha^{-1})				Available P_2O_5(kg ha^{-1})				Available K_2O (kg ha^{-1})			
	30 DAT	60 DAT	90 DAT	AH	30 DAT	60 DAT	90 DAT	AH	30 DAT	60 DAT	90 DAT	AH
T_1	275.97	257.15	252.33	212.68	7.31	6.40	5.85	5.48	217.26	248.69	241.46	203.45
T_2	296.13	289.55	273.60	268.65	10.97	8.95	8.22	6.94	323.89	352.89	343.65	281.06
T_3	319.87	331.29	311.61	290.60	18.64	15.72	15.54	13.71	292.62	301.10	280.30	263.62
T_4	315.37	327.63	309.88	283.50	12.98	10.78	11.70	10.78	278.54	290.33	270.95	257.76
T_5	310.53	305.23	301.05	269.86	14.26	12.24	9.70	11.15	421.10	450.15	403.89	278.30
T_6	306.19	300.01	296.87	269.69	10.42	10.59	10.14	7.86	296.11	328.81	303.06	280.55
T_7	312.62	330.41	308.55	274.02	17.17	12.98	11.88	10.23	448.43	469.20	447.40	407.22
T_8	311.42	309.41	303.35	270.74	13.34	11.33	12.24	11.15	301.04	332.74	317.00	281.06
T_9	297.90	293.73	288.51	269.02	11.15	8.95	8.95	9.14	372.45	399.26	367.18	309.72
T_{10}	295.17	270.74	271.17	255.20	8.04	7.13	6.76	6.21	267.07	380.86	365.91	246.89
T_{11}	296.13	281.19	274.92	259.24	9.69	8.95	8.77	8.04	220.48	252.77	262.92	246.75
T_{12}	296.13	287.46	288.51	267.13	12.79	13.89	12.25	11.51	217.26	282.40	266.89	249.00
S.E. ±	**3.10**	**9.48**	**7.38**	**5.51**	**0.78**	**0.53**	**0.66**	**0.61**	**31.37**	**5.34**	**7.04**	**6.44**
C.D. (P=0.05)	**9.08**	**27.79**	**21.65**	**16.51**	**2.28**	**1.57**	**1.92**	**1.80**	**92.01**	**15.65**	**20.64**	**18.90**